

C L A I M S

1. A radio communication system characterized
2 by comprising a radio transmitter and a radio receiver,
3 said radio transmitter including encoding
4 means for encoding a digital signal to be transmitted,
5 and a transmission antenna which transmits the signal
6 encoded by said encoding means, and
7 said radio receiver including a reception
8 antenna which receives the transmitted signal, and
9 decoding means for performing decoding corresponding to
10 encoding for the signal received by said reception
11 antenna and restoring the digital signal,
12 wherein communication is performed without
13 using any carrier.

2. A radio communication system according to
2 claim 1, characterized in that said encoding means
3 encodes the digital signal to be transmitted by using a
4 code not containing any DC component.

3. A radio communication system according to
2 claim 1, characterized in that
3 said encoding means comprises spreading means
4 for performing a spread spectrum process by multiplying
5 the digital signal to be transmitted by a spreading code
6 and outputting the spread signal to said transmission
7 antenna, and
8 said decoding means comprises despreading
9 means for performing despreading corresponding to the

10 spread spectrum process for the signal received by said
11 reception antenna and restoring the digital signal.

4. A radio communication system according to
2 claim 3, characterized in that the spreading code does
3 not contain any DC component.

5. A radio communication system according to
2 claim 1, characterized in that

3 said encoding means comprises spreading means
4 for performing a spread spectrum process by multiplying
5 the digital signal to be transmitted by a spreading code,
6 and signal generation means for generating an impulse
7 signal in response to rise and fall of a signal spread
8 by said spreading means and outputting the impulse
9 signal to said transmission antenna, and

10 said decoding means comprises despread
11 means for performing despread corresponding to the
12 spread spectrum process for the signal received by said
13 reception antenna, and peak detection means for
14 detecting a peak of the signal despread by said
15 despread means and restoring the digital signal.

6. A radio communication system according to
2 claim 1, characterized in that

3 said encoding means comprises spreading means
4 for performing a spread spectrum process by multiplying
5 the digital signal to be transmitted by a spreading code,
6 and signal generation means for generating an impulse
7 signal in response to rise and fall of a signal spread

8 by said spreading means and outputting the impulse
9 signal to said transmission antenna, and
10 said decoding means comprises signal
11 regeneration means for regenerating the spread signal
12 from the signal received by said reception antenna, and
13 despreading means for performing despreading
14 corresponding to the spread spectrum process for the
15 spread signal output from said signal regeneration means
16 and restoring the digital signal.

7. A radio communication system according to
2 claim 1, characterized in that
3 said encoding means comprises spreading means
4 for performing a spread spectrum process by multiplying
5 the digital signal to be transmitted by a spreading code,
6 and signal generation means for generating an impulse
7 signal in response to rise and fall of a signal spread
8 by said spreading means and outputting the impulse
9 signal to said transmission antenna, and
10 said decoding means comprises signal
11 regeneration means for regenerating the spread signal
12 from the signal received by said reception antenna,
13 despreading means for performing despreading
14 corresponding to the spread spectrum process for the
15 spread signal output from said signal regeneration means,
16 and peak detection means for detecting a peak of the
17 signal despread by said despreading means and restoring
18 the digital signal.

8. A radio communication system according to
2 claim 1, characterized in that
3 said encoding means comprises spreading means
4 for performing a spread spectrum process by multiplying
5 the digital signal to be transmitted by a spreading code,
6 and signal generation means for generating an impulse
7 signal in response to rise and fall of a signal spread
8 by said spreading means and outputting the impulse
9 signal to said transmission antenna, and
10 said decoding means comprises despread
11 means for performing despread corresponding to the
12 spread spectrum process for the signal received by said
13 reception antenna, integrating means for integrating the
14 signal despread by said despread means, and peak
15 detection means for detecting a peak of the signal
16 output from said integrating means and restoring the
17 digital signal.

9. A radio communication system according to
2 claim 1, characterized in that
3 said encoding means comprises spreading means
4 for performing a spread spectrum process by multiplying
5 the digital signal to be transmitted by a spreading code,
6 and signal generation means for generating an impulse
7 signal in response to rise and fall of a signal spread
8 by said spreading means and outputting the impulse
9 signal to said transmission antenna, and
10 said decoding means comprises despread

11 means for performing despreading for the signal received
12 by said reception antenna by using a spreading code
13 corresponding to a differentiated spread signal, and
14 peak detection means for detecting a peak of the signal
15 despread by said despreading means and restoring the
16 digital signal.

10. A radio communication system according to
2 claim 9, characterized in that letting ΔS be the
3 differentiated spread signal, C be a spreading code
4 corresponding to the spread signal ΔS , P be a
5 correlation value between the spread signal ΔS and the
6 spreading code C , and M be a code length of the
7 spreading code C ,

8
$$P \approx \sum_{k=1}^M \left(\Delta S_k \cdot \sum_{r=k}^M C_r \right)$$

9 is established.

11. A radio communication system according to
2 claim 5, characterized in that said signal generation
3 means outputs only an impulse signal in an n th (n is an
4 integer of not less than 2) harmonic band at a spread
5 chip rate.

12. A radio communication system according to
2 claim 6, characterized in that said signal generation
3 means outputs only an impulse signal in an n th (n is an
4 integer of not less than 2) harmonic band at a spread
5 chip rate.

13. A radio communication system according to

2 claim 7, characterized in that said signal generation
3 means outputs only an impulse signal in an nth (n is an
4 integer of not less than 2) harmonic band at a spread
5 chip rate.

14. A radio communication system according to
2 claim 8, characterized in that said signal generation
3 means outputs only an impulse signal in an nth (n is an
4 integer of not less than 2) harmonic band at a spread
5 chip rate.

15. A radio communication system according to
2 claim 9, characterized in that said signal generation
3 means outputs only an impulse signal in an nth (n is an
4 integer of not less than 2) harmonic band at a spread
5 chip rate.

16. A radio transmitter characterized by
2 comprising:
3 encoding means for encoding a digital signal
4 to be transmitted; and
5 a transmission antenna which transmits the
6 signal encoded by said encoding means,
7 wherein the digital signal is transmitted
8 without using any carrier.

17. A radio transmitter according to claim 16,
2 characterized in that said encoding means encodes the
3 digital signal to be transmitted by using a code not
4 containing any DC component.

18. A radio transmitter according to claim 16,

2 characterized in that said encoding means comprises
3 spreading means for performing a spread spectrum process
4 by multiplying the digital signal to be transmitted by a
5 spreading code and outputting the spread signal to said
6 transmission antenna.

19. A radio transmitter according to claim 18,
2 characterized in that the spreading code does not
3 contain any DC component.

20. A radio transmitter according to claim 16,
2 characterized in that said encoding means comprises
3 spreading means for performing a spread spectrum process
4 by multiplying the digital signal to be transmitted by a
5 spreading code, and signal generation means for
6 generating an impulse signal in response to rise and
7 fall of a signal spread by said spreading means and
8 outputting the impulse signal to said transmission
9 antenna.

21. A radio transmitter according to claim 20,
2 characterized in that said signal generation means
3 outputs only an impulse signal in an nth (n is an
4 integer of not less than 2) harmonic band at a spread
5 chip rate.

22. A radio receiver which receives a signal
2 from a radio transmitter that encodes a digital signal
3 to be transmitted and transmits the digital signal
4 without using any carrier, characterized by comprising:
5 a reception antenna which receives the

6 transmitted signal; and

7 decoding means for performing decoding
8 corresponding to encoding for the signal received by
9 said reception antenna and restoring the digital signal.

23. A radio receiver according to claim 22,
2 characterized in that said decoding means performs
3 decoding corresponding to encoding using a code not
4 containing any DC component.

24. A radio receiver according to claim 22,
2 characterized in that

3 said radio receiver receives a signal from the
4 radio transmitter which transmits, without using any
5 carrier, a signal subjected to a spread spectrum process
6 by multiplying the digital signal to be transmitted by a
7 spreading code, and

8 said decoding means comprises despreading
9 means for performing despreading corresponding to the
10 spread spectrum process for the signal received by said
11 reception antenna and restoring the digital signal.

25. A radio receiver according to claim 24,
2 characterized in that the spreading code does not
3 contain any DC component.

26. A radio receiver according to claim 22,
2 characterized in that

3 said radio receiver receives a signal from the
4 radio transmitter which generates an impulse signal in
5 response to rise and fall of a spread signal obtained by

6 performing a spread spectrum process for the digital
7 signal to be transmitted and transmits the impulse
8 signal without using any carrier, and
9 said decoding means comprises despread-
10 means for performing despread- corresponding to the
11 spread spectrum process for the signal received by said
12 reception antenna, and peak detection means for
13 detecting a peak of the signal despread by said
14 despread- means and restoring the digital signal.

27. A radio receiver according to claim 22,
2 characterized in that
3 said radio receiver receives a signal from the
4 radio transmitter which generates an impulse signal in
5 response to rise and fall of a spread signal obtained by
6 performing a spread spectrum process for the digital
7 signal to be transmitted and transmits the impulse
8 signal without using any carrier, and
9 said decoding means comprises signal
10 regeneration means for regenerating the spread signal
11 from the signal received by said reception antenna, and
12 despread- means for performing despread-
13 corresponding to the spread spectrum process for the
14 spread signal output from said signal regeneration means
15 and restoring the digital signal.

28. A radio receiver according to claim 22,
2 characterized in that
3 said radio receiver receives a signal from the

4 radio transmitter which generates an impulse signal in
5 response to rise and fall of a spread signal obtained by
6 performing a spread spectrum process for the digital
7 signal to be transmitted and transmits the impulse
8 signal without using any carrier, and
9 said decoding means comprises signal
10 regeneration means for regenerating the spread signal
11 from the signal received by said reception antenna,
12 despreading means for performing despreading
13 corresponding to the spread spectrum process for the
14 spread signal output from said signal regeneration means,
15 and peak detection means for detecting a peak of the
16 signal despread by said despreading means and restoring
17 the digital signal.

29. A radio receiver according to claim 22,
2 characterized in that
3 said radio receiver receives a signal from the
4 radio transmitter which generates an impulse signal in
5 response to rise and fall of a spread signal obtained by
6 performing a spread spectrum process for the digital
7 signal to be transmitted and transmits the impulse
8 signal without using any carrier, and
9 said decoding means comprises despreading
10 means for performing despreading corresponding to the
11 spread spectrum process for the signal received by said
12 reception antenna, integrating means for integrating the
13 signal despread by said despreading means, and peak

14 detection means for detecting a peak of the signal
15 output from said integrating means and restoring the
16 digital signal.

30. A radio receiver according to claim 22,
2 characterized in that
3 said radio receiver receives a signal from the
4 radio transmitter which generates an impulse signal in
5 response to rise and fall of a spread signal obtained by
6 performing a spread spectrum process for the digital
7 signal to be transmitted and transmits the impulse
8 signal without using any carrier, and
9 said decoding means comprises despreading
10 means for performing despreading for the signal received
11 by said reception antenna by using a spreading code
12 corresponding to a differentiated spread signal, and
13 peak detection means for detecting a peak of the signal
14 despread by said despreading means and restoring the
15 digital signal.

31. A radio receiver according to claim 30,
2 characterized in that letting ΔS be the differentiated
3 spread signal, C be a spreading code corresponding to
4 the spread signal ΔS , P be a correlation value between
5 the spread signal ΔS and the spreading code C , and M be
6 a code length of the spreading code C ,

7
$$P \approx \sum_{k=1}^M \left(\Delta S_k \cdot \sum_{r=k}^M C_r \right)$$

8 is established.

32. A radio communication method characterized
2 by comprising the encoding step of encoding a digital
3 signal to be transmitted, the transmission step of
4 transmitting the signal encoded in the encoding step,
5 the reception step of receiving the transmitted signal,
6 and the decoding step of performing decoding
7 corresponding to encoding for the signal received in the
8 reception step and restoring the digital signal, wherein
9 communication is performed without using any carrier.

33. A radio communication method according to
2 claim 32, characterized in that in the encoding step,
3 the digital signal to be transmitted is encoded using a
4 code not containing any DC component.

34. A radio communication method according to
2 claim 32, characterized in that
3 the encoding step comprises the spreading step
4 of performing a spread spectrum process by multiplying
5 the digital signal to be transmitted by a spreading code,
6 and
7 the decoding step comprises the despreading
8 step of performing despreading corresponding to the
9 spread spectrum process for the signal received in the
10 reception step and restoring the digital signal.

35. A radio communication method according to
2 claim 34, characterized in that the spreading code does
3 not contain any DC component.

36. A radio communication method according to

2 claim 32, characterized in that

3 the encoding step comprises the spreading step
4 of performing a spread spectrum process by multiplying
5 the digital signal to be transmitted by a spreading code,
6 and the signal generation step of generating an impulse
7 signal in response to rise and fall of a signal spread
8 in the spreading step, and

9 the decoding step comprises the despread
10 step of performing despread corresponding to the
11 spread spectrum process for the signal received in the
12 reception step, and the peak detection step of detecting
13 a peak of the signal despread in the despread step
14 and restoring the digital signal.

37. A radio communication method according to
2 claim 32, characterized in that

3 the encoding step comprises the spreading step
4 of performing a spread spectrum process by multiplying
5 the digital signal to be transmitted by a spreading code,
6 and the signal generation step of generating an impulse
7 signal in response to rise and fall of a signal spread
8 in the spreading step, and

9 the decoding step comprises the signal
10 regeneration step of regenerating the spread signal from
11 the signal received in the reception step, and the
12 despread step of performing despread corresponding
13 to the spread spectrum process for the spread signal
14 output in the signal regeneration step and restoring the

15 digital signal.

38. A radio communication method according to
2 claim 32, characterized in that
3 the encoding step comprises the spreading step
4 of performing a spread spectrum process by multiplying
5 the digital signal to be transmitted by a spreading code,
6 and the signal generation step of generating an impulse
7 signal in response to rise and fall of a signal spread
8 in the spreading step, and
9 the decoding step comprises the signal
10 regeneration step of regenerating the spread signal from
11 the signal received in the reception step, the
12 despreding step of performing despreding corresponding
13 to the spread spectrum process for the spread signal
14 output in the signal regeneration step, and the peak
15 detection step of detecting a peak of the signal
16 despread in the despreding step and restoring the
17 digital signal.

39. A radio communication method according to
2 claim 32, characterized in that
3 the encoding step comprises the spreading step
4 of performing a spread spectrum process by multiplying
5 the digital signal to be transmitted by a spreading code,
6 and the signal generation step of generating an impulse
7 signal in response to rise and fall of a signal spread
8 in the spreading step, and
9 the decoding step comprises the despreding

10 step of performing despreading corresponding to the
11 spread spectrum process for the signal received in the
12 reception step, the integrating step of integrating the
13 signal despread in the despreading step, and the peak
14 detection step of detecting a peak of the signal output
15 in the integrating step and restoring the digital signal.

40. A radio communication method according to
2 claim 32, characterized in that

3 the encoding step comprises the spreading step
4 of performing a spread spectrum process by multiplying
5 the digital signal to be transmitted by a spreading code,
6 and the signal generation step of generating an impulse
7 signal in response to rise and fall of a signal spread
8 in the spreading step, and

9 the decoding step comprises the despreading
10 step of performing despreading for the signal received
11 in the reception step by using a spreading code
12 corresponding to a differentiated spread signal, and the
13 peak detection step of detecting a peak of the signal
14 despread in the despreading step and restoring the
15 digital signal.

41. A radio communication method according to
2 claim 40, characterized in that letting ΔS be the
3 differentiated spread signal, C be a spreading code
4 corresponding to the spread signal ΔS , P be a
5 correlation value between the spread signal ΔS and the
6 spreading code C , and M be a code length of the

7 spreading code C,

8
$$P \approx \sum_{k=1}^M \left(\Delta S_k \cdot \sum_{r=k}^M C_r \right)$$

9 is established.

42. A radio communication method according to
2 claim 36, characterized in that in the signal generation
3 step, only an impulse signal in an nth (n is an integer
4 of not less than 2) harmonic band at a spread chip rate
5 is output.

43. A radio communication method according to
2 claim 37, characterized in that in the signal generation
3 step, only an impulse signal in an nth (n is an integer
4 of not less than 2) harmonic band at a spread chip rate
5 is output.

44. A radio communication method according to
2 claim 38, characterized in that in the signal generation
3 step, only an impulse signal in an nth (n is an integer
4 of not less than 2) harmonic band at a spread chip rate
5 is output.

45. A radio communication method according to
2 claim 39, characterized in that in the signal generation
3 step, only an impulse signal in an nth (n is an integer
4 of not less than 2) harmonic band at a spread chip rate
5 is output.

46. A radio communication method according to
2 claim 40, characterized in that in the signal generation
3 step, only an impulse signal in an nth (n is an integer

4 of not less than 2) harmonic band at a spread chip rate
5 is output.

47. A radio transmission method characterized
2 by comprising:
3 the encoding step of encoding a digital signal
4 to be transmitted; and
5 the transmission step of transmitting the
6 encoded signal,
7 wherein the digital signal is transmitted
8 without using any carrier.

48. A radio transmission method according to
2 claim 47, characterized in that in the encoding step,
3 the digital signal to be transmitted is encoded by using
4 a code not containing any DC component.

49. A radio transmission method according to
2 claim 47, characterized in that the encoding step
3 comprises the spreading step of performing a spread
4 spectrum process by multiplying the digital signal to be
5 transmitted by a spreading code and outputting the
6 spectrum-spread signal to the transmission antenna.

50. A radio transmission method according to
2 claim 49, characterized in that the spreading code does
3 not contain any DC component.

51. A radio transmission method according to
2 claim 47, characterized in that the encoding step
3 comprises the spreading step of performing a spread
4 spectrum process by multiplying the digital signal to be

5 transmitted by a spreading code, and the signal
6 generation step of generating an impulse signal in
7 response to rise and fall of a spread signal
8 spectrum-spread in the spreading step.

52. A radio transmission method according to
2 claim 51, characterized in that in the signal generation
3 step, only an impulse signal in an n th (n is an integer
4 of not less than 2) harmonic band at a spread chip rate
5 is output.

53. A radio reception method of receiving a
2 signal from a transmitting side which encodes a digital
3 signal to be transmitted and transmits the digital
4 signal without using any carrier, characterized by
5 comprising:
6 the reception step of receiving the
7 transmitted signal; and
8 the decoding step of performing decoding
9 corresponding to encoding for the signal received in the
10 reception step and restoring the digital signal.

54. A radio reception method according to
2 claim 53, characterized in that in the decoding step,
3 decoding corresponding to encoding using a code not
4 containing any DC component is performed.

55. A radio reception method according to
2 claim 53, characterized in that
3 a receiving side receives a signal from the
4 transmitting side which transmits, without using any

5 carrier, a signal obtained subjected to a spread
6 spectrum process by multiplying the digital signal to be
7 transmitted by a spreading code, and
8 the decoding step comprises the despreading
9 step of performing despreading corresponding to a spread
10 spectrum process for the signal received in the
11 reception step and restoring the digital signal.

56. A radio reception method according to
2 claim 55, characterized in that the spreading code does
3 not contain any DC component.

57. A radio reception method according to
2 claim 53, characterized in that
3 a receiving side receives a signal from the
4 transmitting side which generates an impulse signal in
5 response to rise and fall of a spread signal obtained by
6 performing a spread spectrum process for the digital
7 signal to be transmitted and transmits the impulse
8 signal without using any carrier, and
9 the decoding step comprises the despreading
10 step of performing despreading corresponding to the
11 spread spectrum process for the signal received in the
12 reception step, and the peak detection step of detecting
13 a peak of the despread signal and restoring the digital
14 signal.

58. A radio reception method according to
2 claim 53, characterized in that
3 a receiving side receives a signal from the

4 transmitting side which generates an impulse signal in
5 response to rise and fall of a spread signal obtained by
6 performing a spread spectrum process for the digital
7 signal to be transmitted and transmits the impulse
8 signal without using any carrier, and
9 the decoding step comprises the signal
10 regeneration step of regenerating the spread signal from
11 the signal received in the reception step, and the
12 despreading step of performing despreading corresponding
13 to the spread spectrum process for the regenerated
14 spread signal and restoring the digital signal.

59. A radio reception method according to
2 claim 53, characterized in that
3 a receiving side receives a signal from the
4 transmitting side which generates an impulse signal in
5 response to rise and fall of a spread signal obtained by
6 performing a spread spectrum process for the digital
7 signal to be transmitted and transmits the impulse
8 signal without using any carrier, and
9 the decoding step comprises the signal
10 regeneration step of regenerating the spread signal from
11 the signal received in the reception step, the
12 despreading step of performing despreading corresponding
13 to the spread spectrum process for the regenerated
14 spread signal, and the peak detection step of detecting
15 a peak of the despread signal and restoring the digital
16 signal.

60. A radio reception method according to
2 claim 53, characterized in that
3 a receiving side receives a signal from the
4 transmitting side which generates an impulse signal in
5 response to rise and fall of a spread signal obtained by
6 performing a spread spectrum process for the digital
7 signal to be transmitted and transmits the impulse
8 signal without using any carrier, and
9 the decoding step comprises the despread
10 step of performing despread corresponding to the
11 spread spectrum process for the signal received in the
12 reception step, the integrating step of integrating the
13 despread signal, and the peak detection step of
14 detecting a peak of the integrated signal and restoring
15 the digital signal.

61. A radio reception method according to
2 claim 53, characterized in that
3 a receiving side receives a signal from the
4 transmitting side which generates an impulse signal in
5 response to rise and fall of a spread signal obtained by
6 performing a spread spectrum process for the digital
7 signal to be transmitted and transmits the impulse
8 signal without using any carrier, and
9 the decoding step comprises the despread
10 step of performing despread for the signal received
11 in the reception step by using a spreading code
12 corresponding to a differentiated spread signal, and the

13 peak detection step of detecting a peak of the despread
14 signal and restoring the digital signal.

62. A radio reception method according to
2 claim 61, characterized in that letting ΔS be the
3 differentiated spread signal, C be a spreading code
4 corresponding to the spread signal ΔS , P be a
5 correlation value between the spread signal ΔS and the
6 spreading code C , and M be a code length of the
7 spreading code C ,

8
$$P \approx \sum_{k=1}^M \left(\Delta S_k \cdot \sum_{r=k}^M C_r \right)$$

9 is established.